OIPE
APR 07 2005
PATENT & TRADEMARK

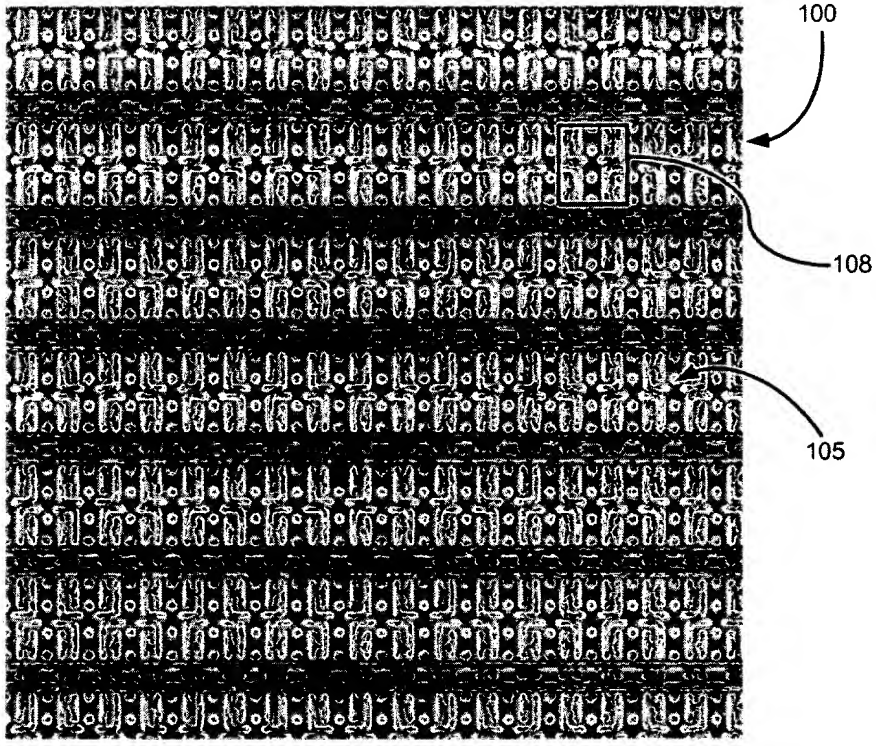


Figure 1A

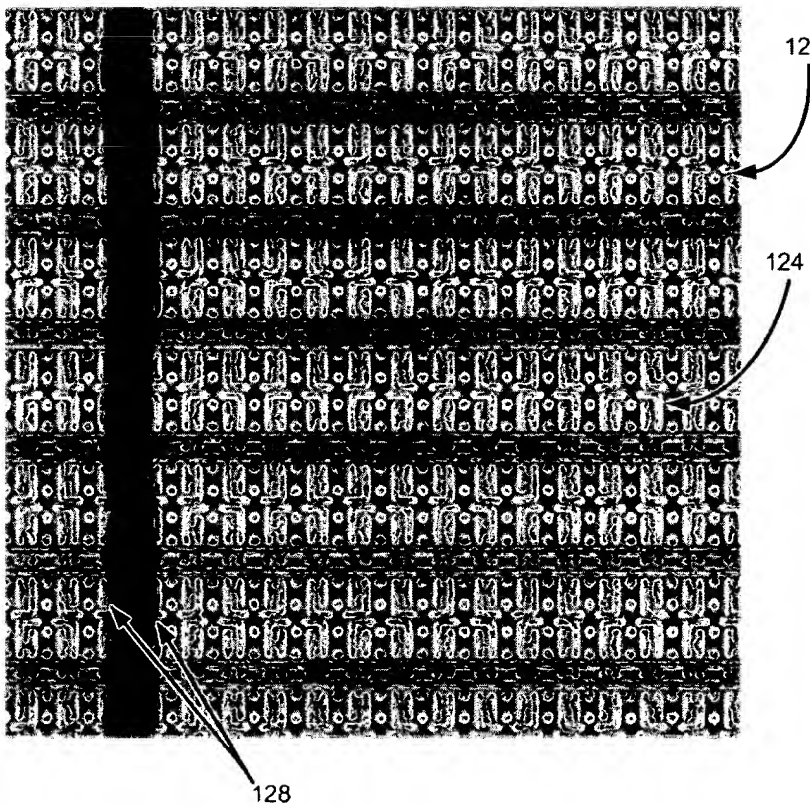


Figure 1B

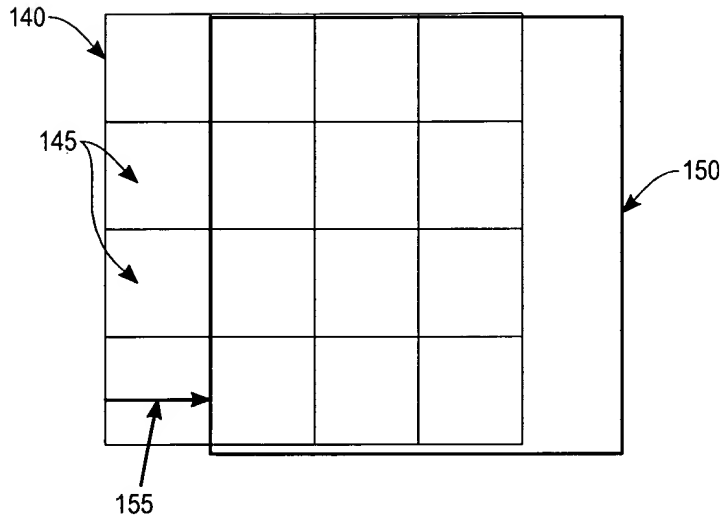


Fig. 1C (Prior Art)

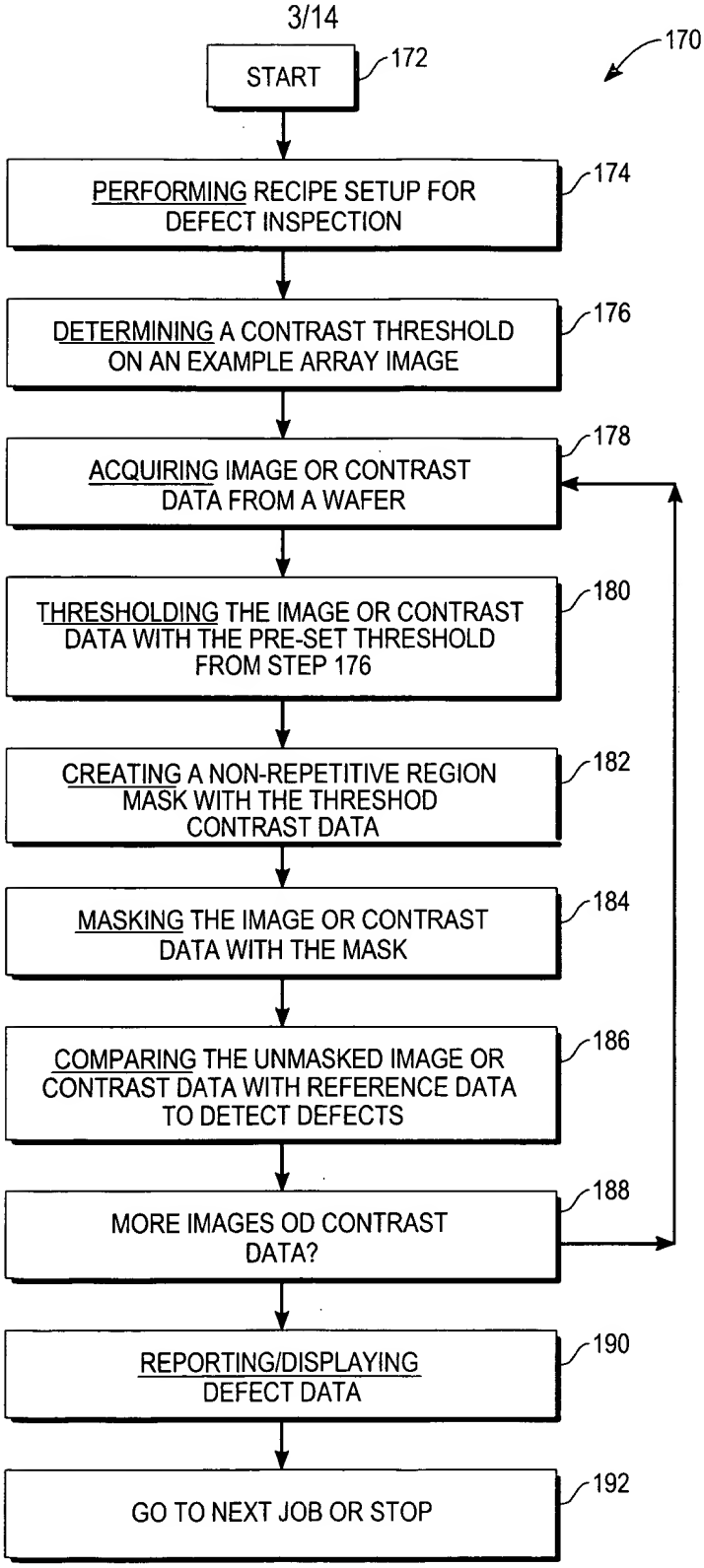

170
START
172
PERFORMING RECIPE SETUP FOR DEFECT INSPECTION
174
DETERMINING A CONTRAST THRESHOLD ON AN EXAMPLE ARRAY IMAGE
176
ACQUIRING IMAGE OR CONTRAST DATA FROM A WAFER
178
THRESHOLDING THE IMAGE OR CONTRAST DATA WITH THE PRE-SET THRESHOLD FROM STEP 176
180
CREATING A NON-REPETITIVE REGION MASK WITH THE THRESHOD CONTRAST DATA
182
MASKING THE IMAGE OR CONTRAST DATA WITH THE MASK
184
COMPARING THE UNMASKED IMAGE OR CONTRAST DATA WITH REFERENCE DATA TO DETECT DEFECTS
186
MORE IMAGES OD CONTRAST DATA?
188
REPORTING/DISPLAYING DEFECT DATA
190
GO TO NEXT JOB OR STOP
192

Fig. 1D

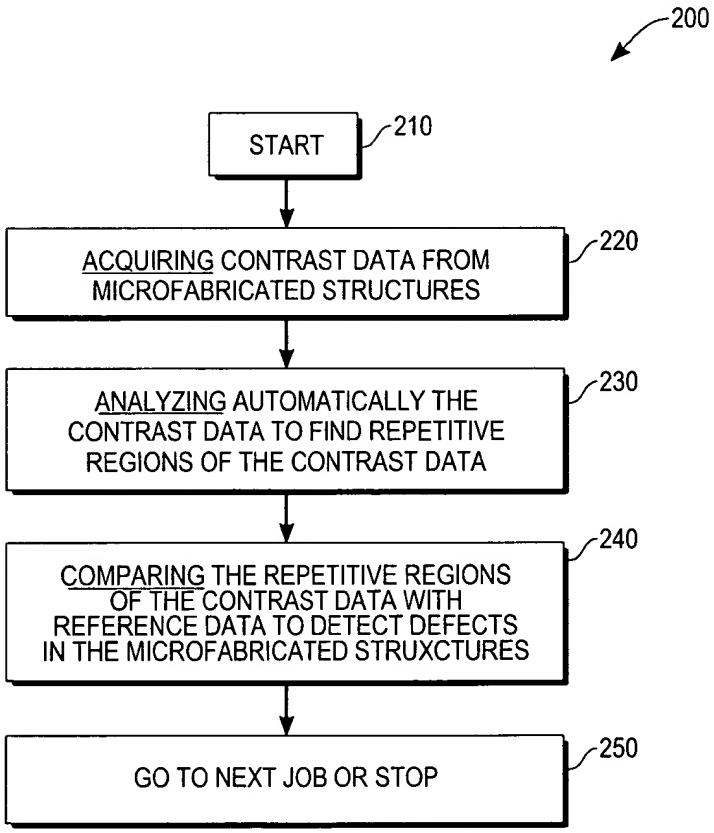

200
START
210
ACQUIRING CONTRAST DATA FROM MICROFABRICATED STRUCTURES
220
ANALYZING AUTOMATICALLY THE CONTRAST DATA TO FIND REPETITIVE REGIONS OF THE CONTRAST DATA
230
COMPARING THE REPETITIVE REGIONS OF THE CONTRAST DATA WITH REFERENCE DATA TO DETECT DEFECTS IN THE MICROFABRICATED STRUXCTURES
240
GO TO NEXT JOB OR STOP
250

Fig. 2

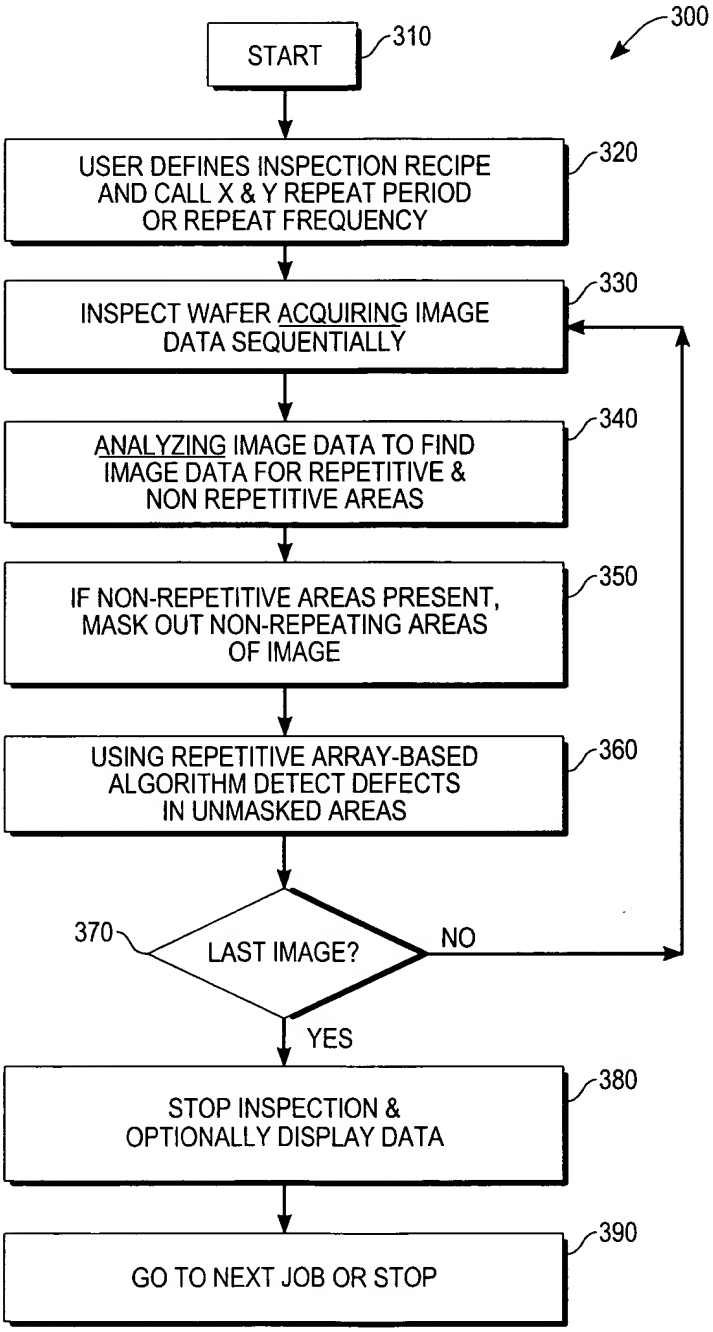

300
START
310
USER DEFINES INSPECTION RECIPE AND CALL X & Y REPEAT PERIOD OR REPEAT FREQUENCY
320
INSPECT WAFER ACQUIRING IMAGE DATA SEQUENTIALLY
330
ANALYZING IMAGE DATA TO FIND IMAGE DATA FOR REPETITIVE & NON REPETITIVE AREAS
340
IF NON-REPETITIVE AREAS PRESENT, MASK OUT NON-REPEATING AREAS OF IMAGE
350
USING REPETITIVE ARRAY-BASED ALGORITHM DETECT DEFECTS IN UNMASKED AREAS
360
370
LAST IMAGE?
NO
YES
STOP INSPECTION & OPTIONALLY DISPLAY DATA
380
GO TO NEXT JOB OR STOP
390

Fig. 3

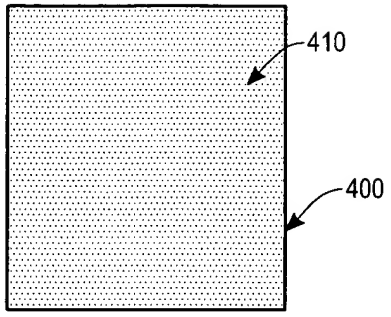


Fig. 4A

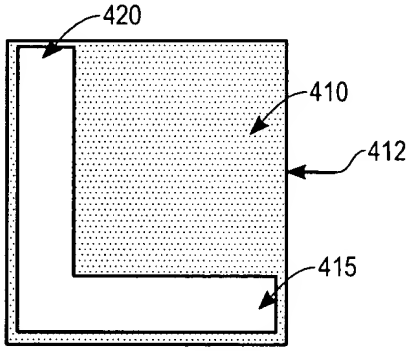


Fig. 4B

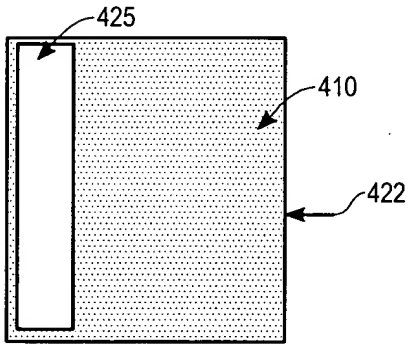


Fig. 4C

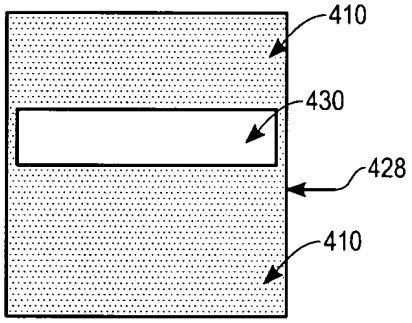


Fig. 4D

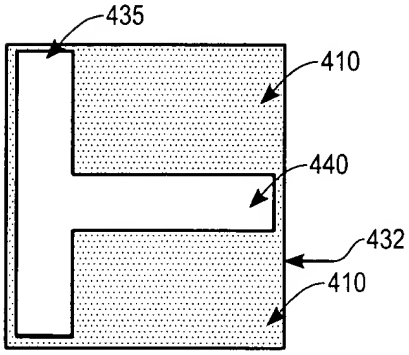


Fig. 4E

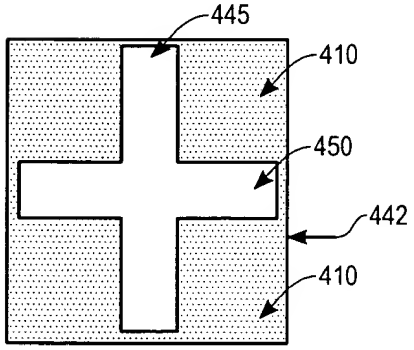


Fig. 4F

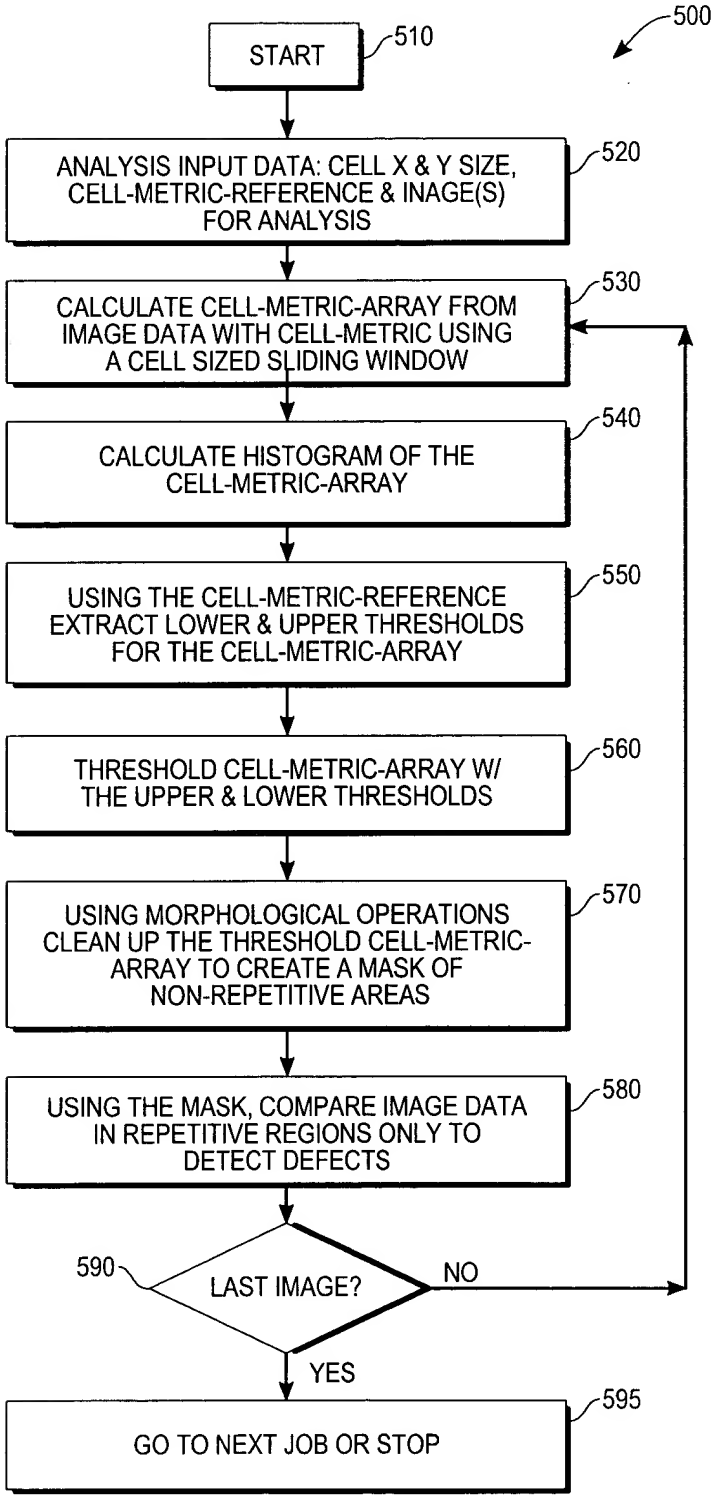

500
START
510
ANALYSIS INPUT DATA: CELL X & Y SIZE, CELL-METRIC-REFERENCE & INAGE(S) FOR ANALYSIS
520
CALCULATE CELL-METRIC-ARRAY FROM IMAGE DATA WITH CELL-METRIC USING A CELL SIZED SLIDING WINDOW
530
CALCULATE HISTOGRAM OF THE CELL-METRIC-ARRAY
540
USING THE CELL-METRIC-REFERENCE EXTRACT LOWER & UPPER THRESHOLDS FOR THE CELL-METRIC-ARRAY
550
THRESHOLD CELL-METRIC-ARRAY W/ THE UPPER & LOWER THRESHOLDS
560
USING MORPHOLOGICAL OPERATIONS CLEAN UP THE THRESHOLD CELL-METRIC-ARRAY TO CREATE A MASK OF NON-REPETITIVE AREAS
570
USING THE MASK, COMPARE IMAGE DATA IN REPETITIVE REGIONS ONLY TO DETECT DEFECTS
580
590
LAST IMAGE?
NO
YES
GO TO NEXT JOB OR STOP
595

Fig. 5

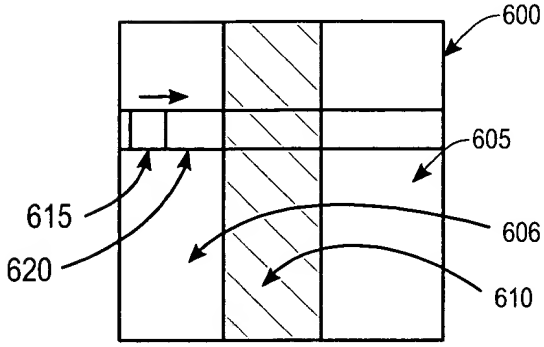


Fig. 6A

Fig. 6B

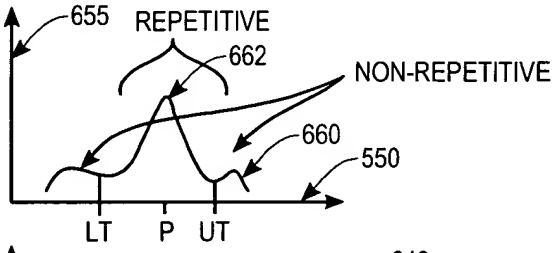


Fig. 6C

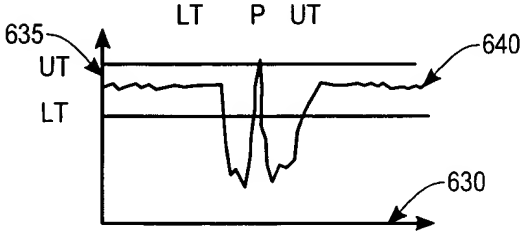


Fig. 6D

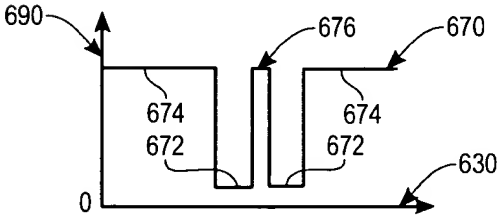


Fig. 6E

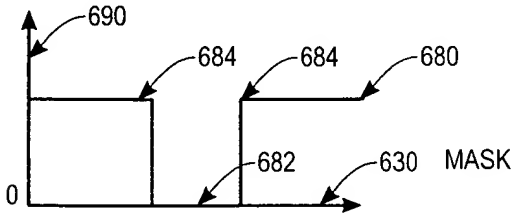


Fig. 6F

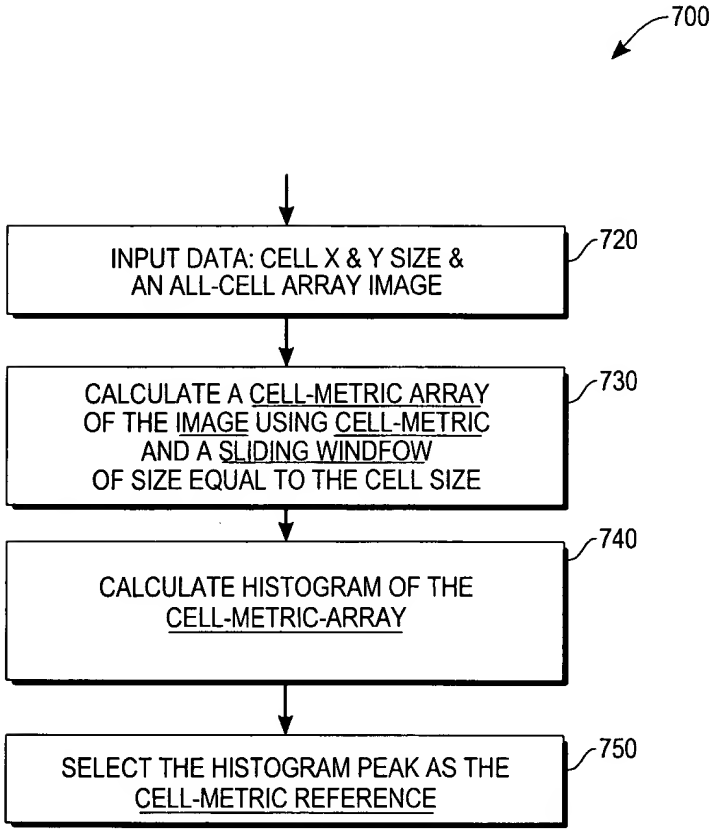

700
INPUT DATA: CELL X & Y SIZE & AN ALL-CELL ARRAY IMAGE
720
CALCULATE A CELL-METRIC ARRAY OF THE IMAGE USING CELL-METRIC AND A SLIDING WINDFOW OF SIZE EQUAL TO THE CELL SIZE
730
CALCULATE HISTOGRAM OF THE CELL-METRIC-ARRAY
740
SELECT THE HISTOGRAM PEAK AS THE CELL-METRIC REFERENCE
750

Fig. 7

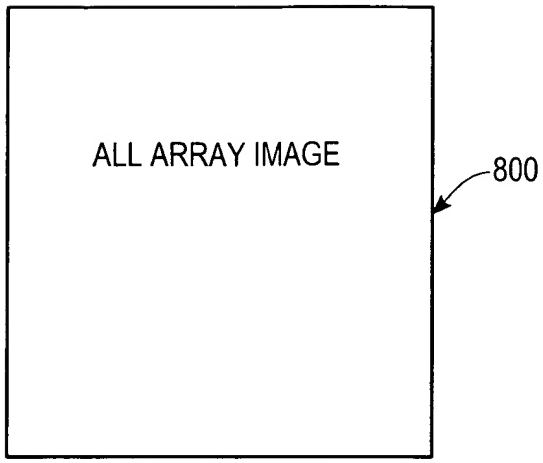


Fig. 8A

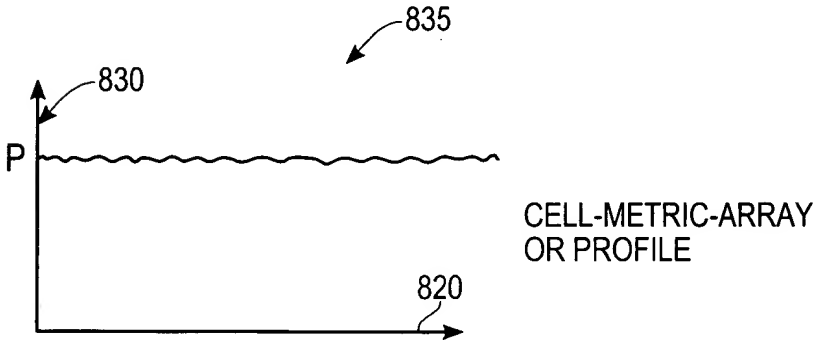


Fig. 8B

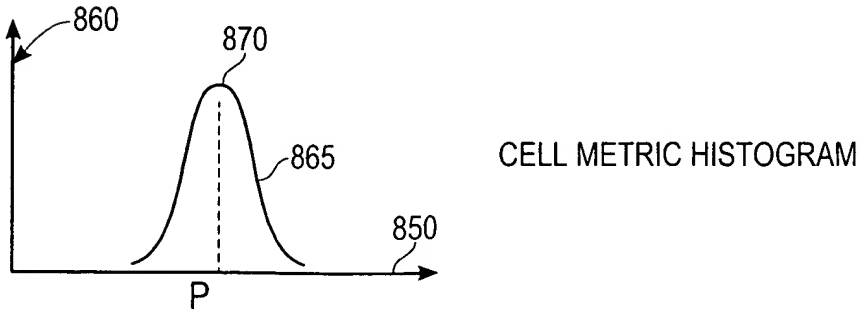
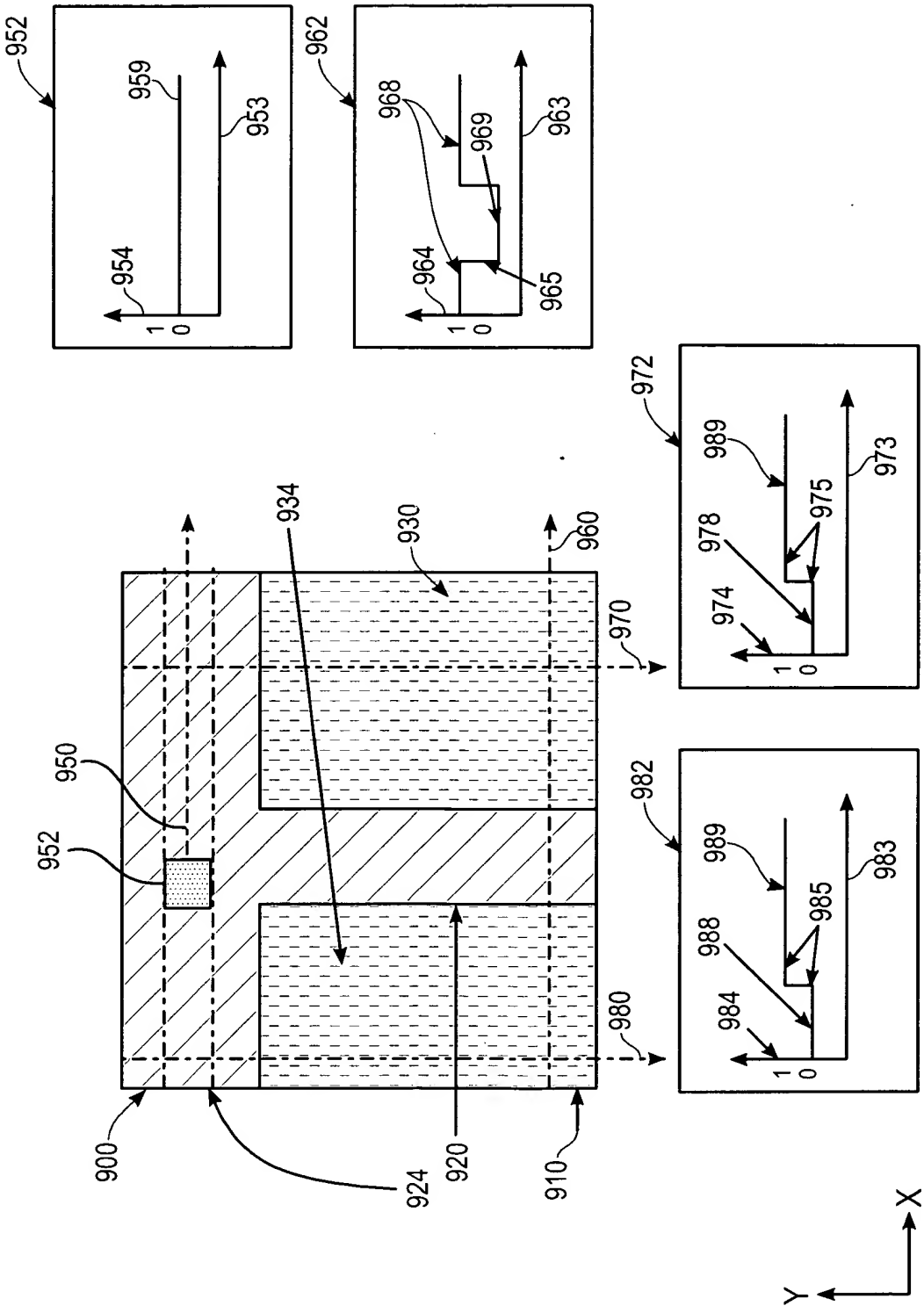


Fig. 8C

Fig. 9A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959
953
954
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962
968
969
963
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965
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978
974
1
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934
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924
920
910
X
Y

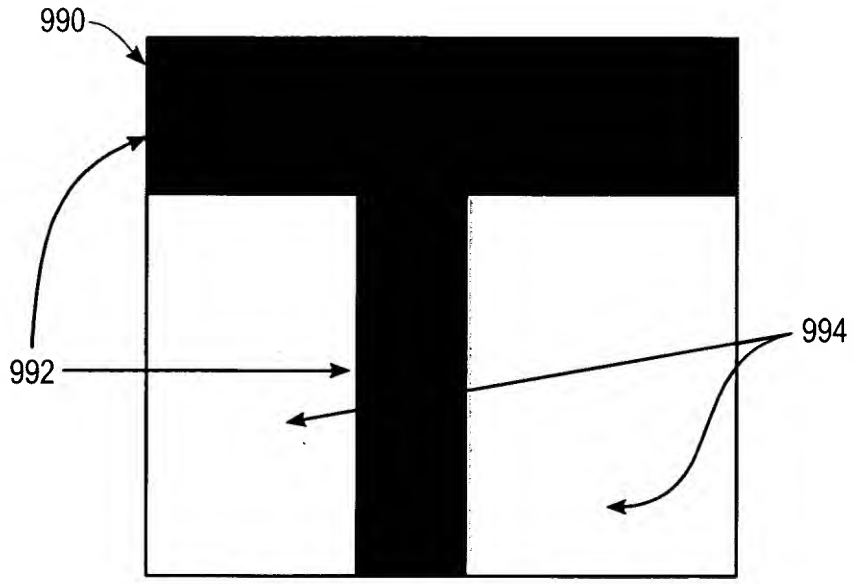

Fig. 9B

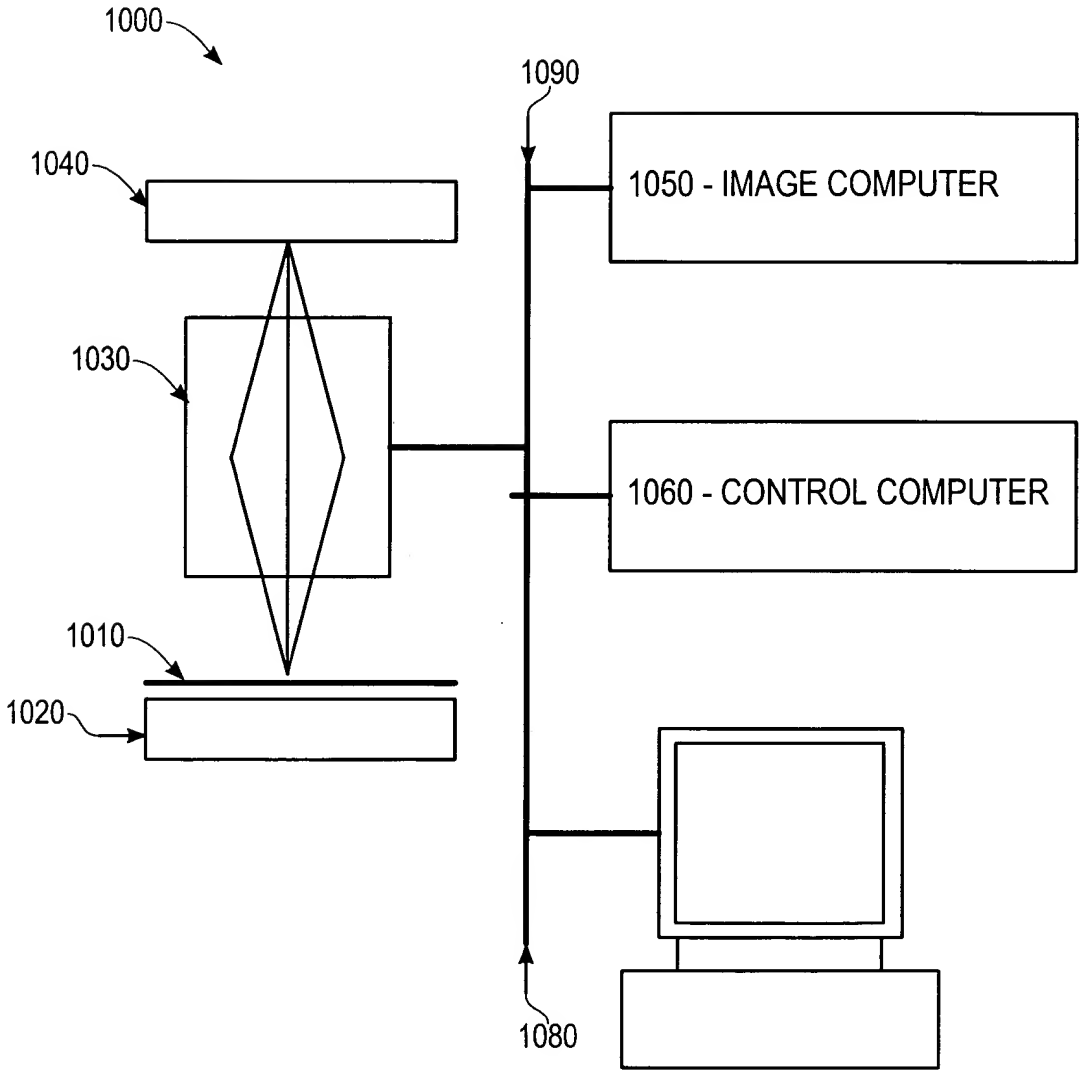
1000
1090
1040
1050 - IMAGE COMPUTER
1030
1060 - CONTROL COMPUTER
1010
1020
1080

Fig. 10

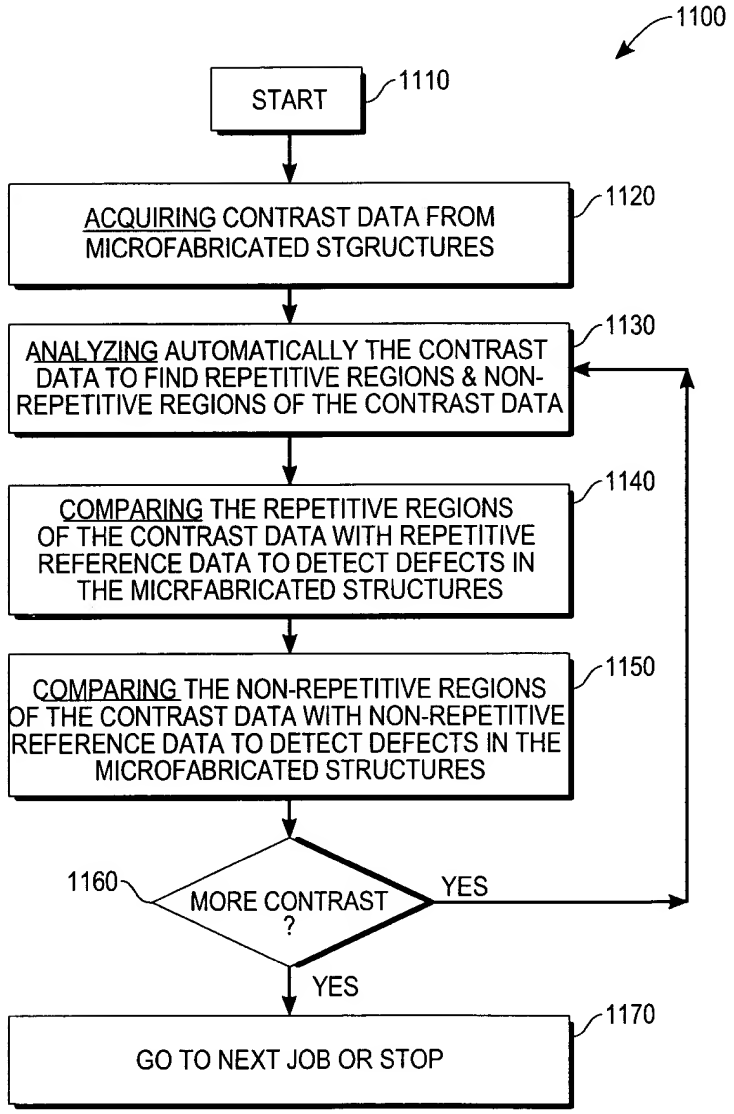
1100
START
1110
ACQUIRING CONTRAST DATA FROM MICROFABRICATED STGRUCTURES
1120
ANALYZING AUTOMATICALLY THE CONTRAST DATA TO FIND REPETITIVE REGIONS & NON-REPETITIVE REGIONS OF THE CONTRAST DATA
1130
COMPARING THE REPETITIVE REGIONS OF THE CONTRAST DATA WITH REPETITIVE REFERENCE DATA TO DETECT DEFECTS IN THE MICRFABRICATED STRUCTURES
1140
COMPARING THE NON-REPETITIVE REGIONS OF THE CONTRAST DATA WITH NON-REPETITIVE REFERENCE DATA TO DETECT DEFECTS IN THE MICROFABRICATED STRUCTURES
1150
1160
MORE CONTRAST ?
YES
YES
GO TO NEXT JOB OR STOP
1170

Fig. 11